



Changes in WIPP Monitoring Programs from CCA to CRA

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Compliance Monitoring Program

Program Specific to 40 CFR 191.14 Assurance Requirements

- **Program's monitoring parameters are the result of a required 40 CFR 194.42 analysis. Analysis concluded that there were 10 parameters important to long-term performance that should be monitored in the Compliance Monitoring Program**
 - **Monitoring Parameter Assessments reported per 40 CFR 194.4 requirements**
- Note: Other monitoring programs are carried out at the WIPP site that are not part of this (EPA) Compliance Monitoring Program**



Compliance Monitoring Program (2)

- **Uses data from operational sampling and monitoring programs**
- **Derives values for Compliance Monitoring Parameters (COMPs)**
- **Evaluates values against performance expectations**
- **Flags unplanned or significant changes**
- **Initiates investigations to address specific issues raised by COMPs assessment**



COMPs

- **Creep closure and stresses**
- **Extent of brittle deformation**
- **Initiation of brittle deformation**
- **Displacement of deformation features**
- **Change in Culebra groundwater composition**
- **Change in Culebra groundwater flow**
- **Drilling rate**
- **Probability of encountering a Castile brine reservoir**
- **Subsidence**
- **Waste Activity**



Monitoring Programs Implemented to Monitor COMPs

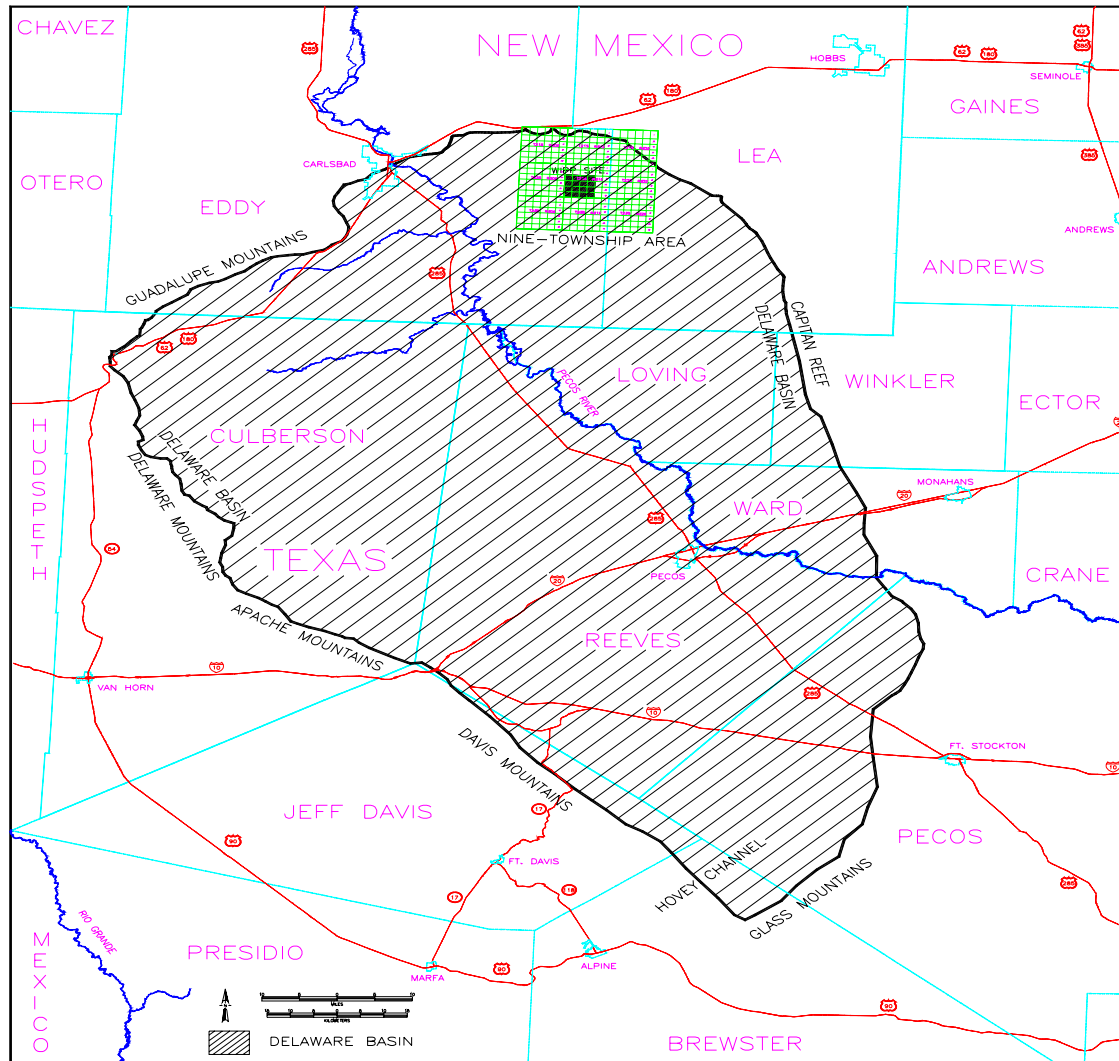
- **Delaware Basin Drilling Surveillance**
- **Geotechnical Monitoring**
- **Subsidence Monitoring**
- **WIPP Waste Information System (WWIS)**
- **Groundwater Monitoring**



Delaware Basin Drilling Surveillance Program

- **Current drilling rates and practices**
- **Castile brine reservoir encounters**
- **Status of solution mining in the Delaware Basin**
- **Gas storage projects**
- **Salt-water disposal and brine injection wells**
- **Potash mining and leases**
- **Status of all well activities**

Delaware Basin





Current Drilling Rate

- Calculation is made on the basis of a 100-year floating average
- For the CCA, the drilling rate for deep (>655 m) holes was calculated to be 46.8 boreholes per square kilometer over 10,000 years
- 1,335 additional deep boreholes were drilled through September 2002, increasing the CRA drilling rate to 52.5 deep boreholes per square kilometer over 10,000 years
- The calculated drilling rate will continue to rise through at least 2011 because no wells are being lost as the time window progresses through the early 1900's



Castile Brine Encounters

- **27 Castile brine encounters had been reported in the New Mexico portion of the Delaware Basin through 1996**
- **5 additional encounters were reported between 1996 and 2002**
- **No changes have been to the brine reservoir probability distribution. The CRA uses the PAVT parameters.**



Solution Mining

- **No solution mining has occurred at potash mines in the Delaware Basin**
- **Mississippi Chemical submitted a plan to the BLM in March 2002 for solution mining at the Eddy Potash facility (outside the Delaware Basin) but has not followed up (Mississippi Chemical recently sold its Carlsbad properties to Intrepid Mining)**
- **The DOE is not aware of any plans to solution mine potash in the Delaware Basin**
- **Sulfur solution mining within the Delaware Basin in Orla, Texas was terminated in June 1999**



Other Delaware Basin Monitoring

- **No changes have been observed in drilling practices (e.g., no air drilling)**
- **No gas storage projects have been proposed**
- **The number of active injection and salt-water disposal wells has increased from 27 to 39 as of September 31, 2002**
- **Potash mining continues as expected**



Geotechnical Monitoring Program

- **Creep closure**
 - Convergence monitoring
- **Extent of deformation**
 - Deformation monitoring
- **Initiation of brittle deformation**
 - Fracture mapping
- **Displacement of deformation features**
 - Stratigraphy
 - Fracture mapping



Geotechnical Monitoring Results

- **Continued excavation deformation**
 - No observable change in mechanism
- **New mining effects on existing openings**
 - Deformation response as expected
- **Monitoring station layout changes**
 - Monitoring locations change as new areas are mined and existing areas are closed
 - Panel 1 is closed and no longer monitored
 - Panel 3 is currently being instrumented concurrent with mining



Subsidence Monitoring Program

- **Approximately 0.05 ft of subsidence was observed over Panel 1 from 1994 to 2002**
- **Observed subsidence is within the Backfill Engineering Analysis Report (BEAR) predictions**



WIPP Waste Information System

- **Tracks 10 radionuclides:**

^{241}Am , ^{238}Pu , ^{239}Pu , ^{240}Pu , ^{242}Pu , ^{233}U , ^{234}U , ^{238}U ,
 ^{90}Sr , and ^{137}Cs

- **Tracks other radionuclides as reported by generator sites**
- **Tracks 14 waste material parameters:**

Iron-base metal alloys, aluminum-base metal alloys, other metals/alloys, other inorganic materials, vitrified materials, cellulosics, rubber, plastics, solidified inorganic material, solidified organic material, cement (solidified), soils, steel container materials, plastic/liners container materials



Groundwater Monitoring Program

- **Water quality sampling in WQSP-1, 2, 3, 4, 5, 6 (all Culebra), and 6a (Dewey Lake)**
- **Water-level monitoring in Culebra wells**
- **Water-level monitoring in wells completed to other units**
- **Pressure-density surveys**



Culebra Water Quality

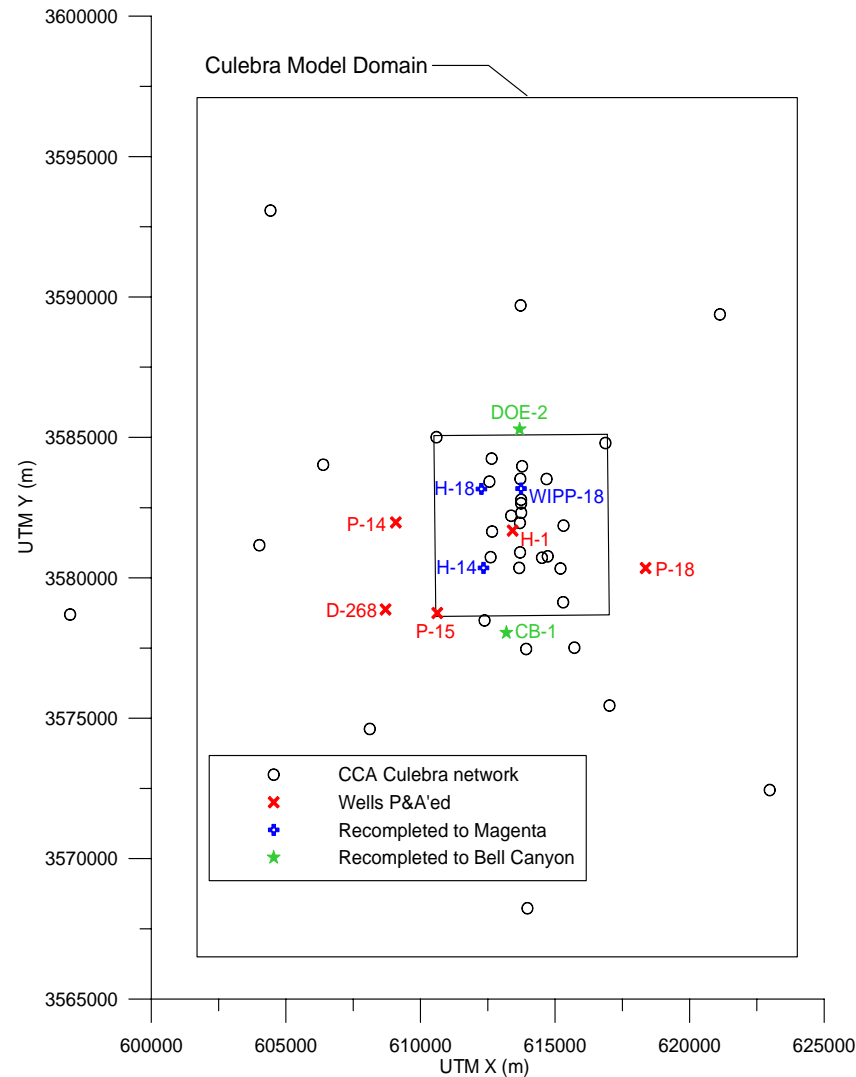
- Ten rounds of semi-annual sampling were used to define baseline concentrations and 95% confidence intervals for major ions:
 Na^+ , Ca^{2+} , Mg^{2+} , K^+ , Cl^- , SO_4^{2-} , HCO_3^-
- WQSP-1, 2, 3, 4, 5, 6, and 6a are sampled twice a year
- Analytical results are compared to baseline values to detect changes
- Only change observed is K^+ concentrations appearing to trend higher—have not ruled out analytical errors



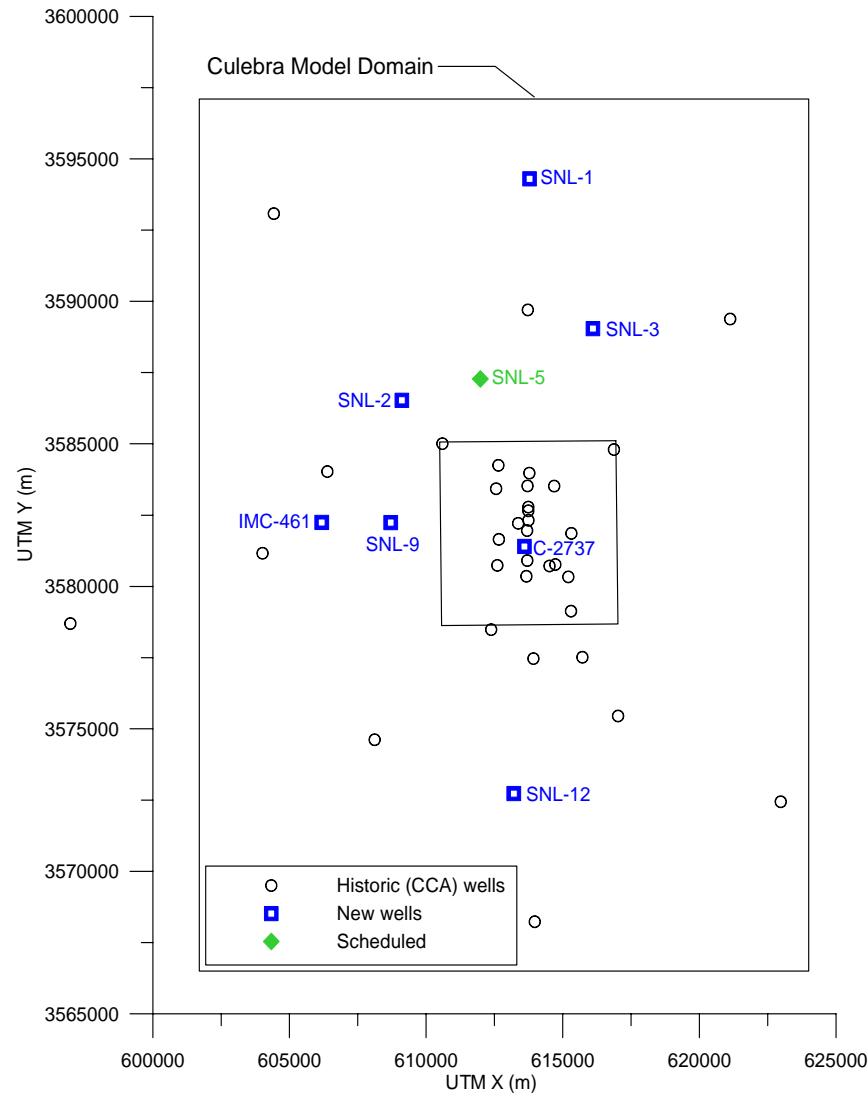
Culebra Water Levels

- **Culebra monitoring network has changed since the CCA, in part to address water-level changes**
- **Culebra water levels generally rose during the first certification monitoring period (data cutoff late 2002), initiating an ongoing investigation and modification of heads in CRA modeling**
- **Water levels continued to rise through early 2003**
- **Since mid-2003, water levels have been dropping in most wells, especially in Nash Draw and northwestern wells**

Culebra Monitoring Wells Removed Since CCA



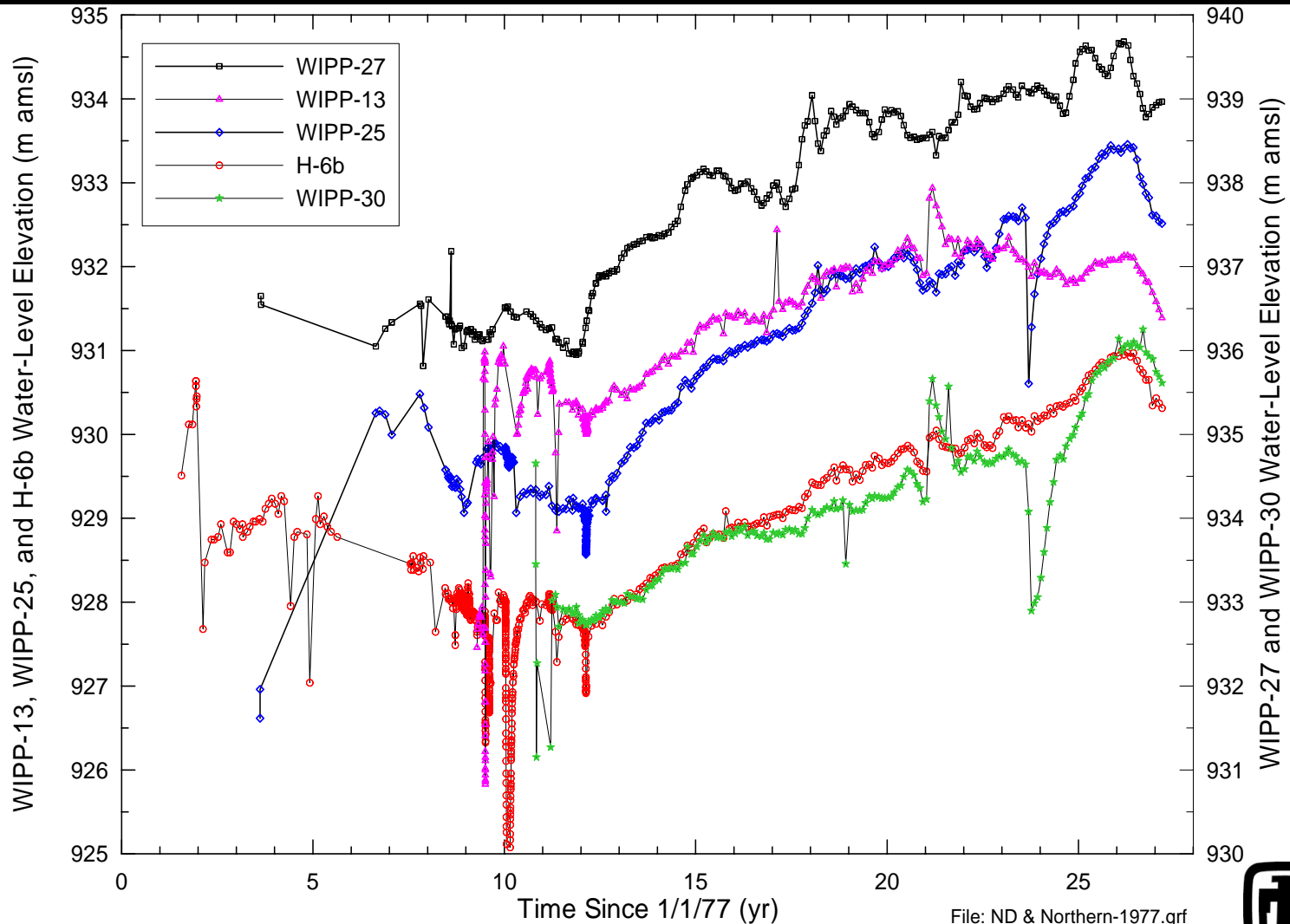
Culebra Monitoring Wells Added Since CCA



Culebra Head Changes From CCA through 2002

Well	CCA Freshwater Head (m amsl)	2002 Freshwater Head (m amsl)		Well	CCA Freshwater Head (m amsl)	2002 Freshwater Head (m amsl)
AEC-7	932.0	933.0		P-14	926.9	NA
CB-1	911.1	not available (NA)		P-15	917.8	NA
D-268	915.2	NA		P-17	909.3	914.0
DOE-1	914.3	916.4		WIPP-12	933.6	935.8
DOE-2	934.7	NA		WIPP-13	933.7	935.3
ERDA-9	not used (NU)	922.1		WIPP-18	930.5	NA
H-1	921.6	NA		WIPP-19	NU	938.5
H-2b2	924.8	927.0		WIPP-21	NU	927.1
H-3b2	914.8	917.9		WIPP-22	NU	933.5
H-4b	911.4	916.0		WIPP-25	928.7	932.5
H-5b	934.2	936.9		WIPP-26	918.5	921.5
H-6b	932.0	934.7		WIPP-27	938.1	941.4
H-7b1	912.7	913.9		WIPP-28	937.5	NA
H-9b	906.4	NA		WIPP-29	NU	905.4
H-10	921.3	922.2		WIPP-30	934.1	938.1
H-11b4	912.4	915.7		WQSP-1	NU	936.4
H-12	913.5	916.9		WQSP-2	NU	939.0
H-14	916.9	NA		WQSP-3	NU	935.7
H-15	916.1	NA		WQSP-4	NU	918.5
H-17	911.0	918.2		WQSP-5	NU	917.8
H-18	932.4	NA		WQSP-6	NU	920.6
H-19b0	NU	918.3		USGS-1	909.8	NA

Nash Draw and Northern Culebra Hydrographs

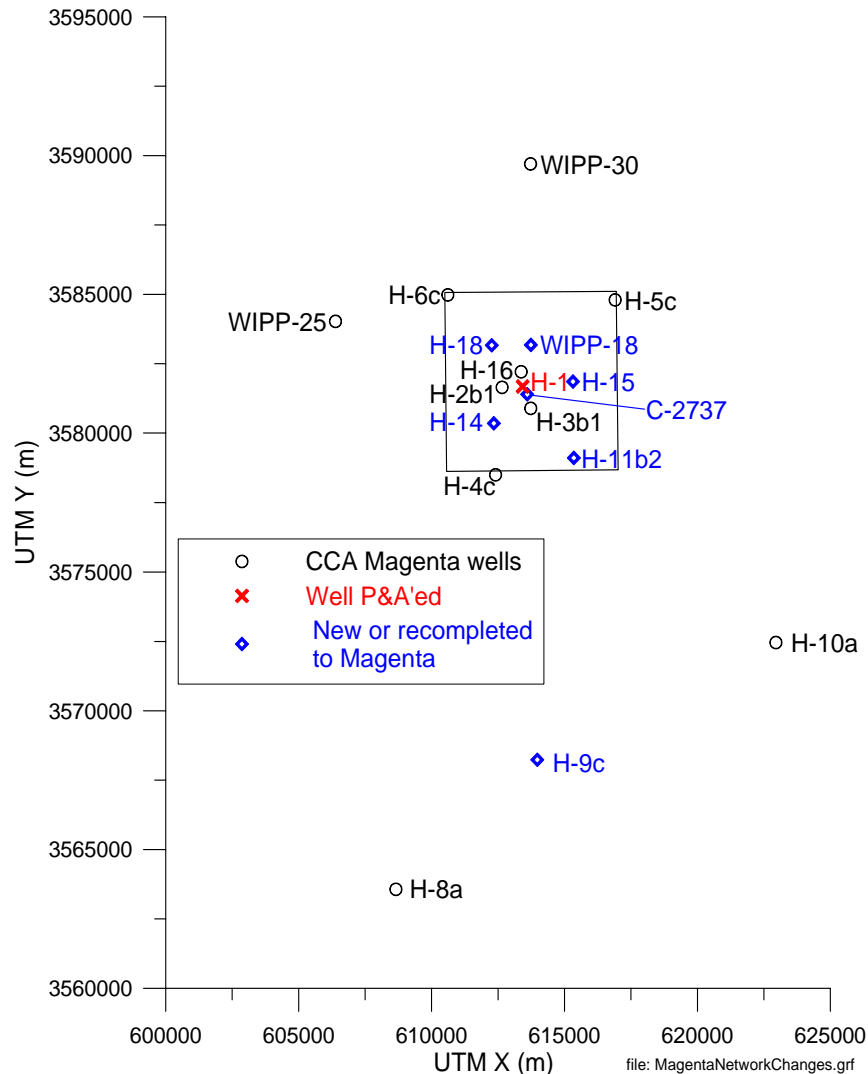




Other Monitoring Network Changes

- 6 redundant Culebra wells were recompleted to the Magenta, and one new dual Culebra-Magenta well (C-2737) was drilled
- DOE-2 and CB-1 were converted to permanent Bell Canyon completions, removing access to the Culebra
- Magenta water levels have generally oscillated within ± 1 m since the CCA; H-6c has been rising ~ 0.17 m/yr for over 11 yr

Changes to Magenta Monitoring Network





Pressure-Density Surveys

- **Pressure-density surveys are conducted annually in Culebra wells to determine the average density of the water standing in the wells**
- **This information is used to convert measured water levels to freshwater heads for historic comparisons and use in modeling**
- **Pressure-density surveys are conducted in wells completed to other units on an as-needed basis**



Conclusions

- **WIPP monitoring programs to date have not identified any conditions outside PA expectations, with the exception of Culebra water levels**
- **Scenarios that might explain the observed water-level changes are being evaluated through modeling and field data collection, including new wells**
- **The CRA uses new T fields that incorporated new information derived from the Culebra groundwater level monitoring program**